

WHAT IS CLAIMED IS:

1. A supersonic aircraft comprising:
a wing having upper and lower surfaces and extending from a leading edge to a trailing edge;
at least two engine nacelles coupled to the lower surface of the wing on the trailing edge;
an inverted V-tail coupled to the wing comprising a central vertical stabilizer, at least two inverted stabilizers coupled to sides of the central vertical stabilizer and coupled to the wing and supporting the at least two engine nacelles, and at least two ruddervators respectively pivotally coupled to the at least two inverted stabilizers; and
a controller coupled to the at least two ruddervators capable of adjusting the aircraft longitudinal lift distribution throughout a flight envelope to maintain a reduced sonic boom and reduced drag trim condition.
2. The aircraft according to Claim 1 wherein:
the ruddervators have sufficient torsional stiffness to reduce or minimize flutter resulting from ruddervator rotation coupling with V-tail bending and torsion.
3. The aircraft according to Claim 1 wherein:
the controller controls asymmetric deflection of the ruddervators for roll control in synchronization with the rudder for directional control.
4. A supersonic aircraft comprising:
a wing having upper and lower surfaces and extending forward from a leading edge aft to a trailing edge;
an inverted V-tail coupled to the wing comprising a central vertical stabilizer with leading and trailing edges, and at least two inverted stabilizers coupled to sides of the central vertical stabilizer and coupled to the wing; and
a rudder pivotally mounted on the trailing edge of the central vertical stabilizer, the rudder having a sufficient area and rudder control sizing to enable

adequate yaw acceleration to achieve at least 8 degrees of yaw angle change within four seconds for de crab and a rudder actuator rate less than 60 degrees/second.

5. The aircraft according to Claim 4 wherein:

the rudder has an area that is greater than 60% of the area of the central vertical stabilizer.

6. The aircraft according to Claim 4 wherein:

the rudder has a sufficient area and rudder control sizing to counteract asymmetric engine thrust in the event of a single engine failure.

7. The aircraft according to Claim 4 wherein:

the rudder has a sufficient area and rudder control sizing to attain a minimum control speed in air (V_{mca}) of approximately 165 knots, the V_{mca} being the speed at which the rudder is adequate to counteract asymmetric engine thrust with a bank angle less than or equal to 5 degrees.

8. The aircraft according to Claim 4 further comprising:

at least two engine nacelles coupled to the lower surface of the wing on the trailing edge; and

controller coupled to the at least two ruddervators capable of adjusting yaw axis using sideslip command control law and roll axis using sideslip command control law, in the yaw axis pilot pedal input being interpreted as sideslip angle demand and pilot roll stick input being interpreted as roll rate demand.

9. The aircraft according to Claim 4 wherein:

the rudder is sufficiently large and the inverted V-tail is configured sufficiently aft to attain rudder yaw control for single engine failures.

10. The aircraft according to Claim 4 further comprising:
a fuselage abutting to the wing and extending forward and aft along a longitudinal axis, the aft portion of the fuselage forming a fuselage tail segment;
wherein:
the rudder is merged with the fuselage tail segment so that the rudder and tail cone rotate pivotally with respect to the central vertical stabilizer and the fuselage.
11. A supersonic aircraft comprising:
a fuselage extending forward and aft about a longitudinal axis, the fuselage having upper and lower surfaces, the lower surface having a general axial curvature about the longitudinal axis and a local aft flattening;
a wing coupled inboard to the fuselage and extending outboard, and having a forward leading edge to an aft trailing edge;
an inverted V-tail coupled to the wing and fuselage comprising a central vertical stabilizer, at least two inverted stabilizers coupled to sides of the central vertical stabilizer and to the wing outboard of the fuselage; and
a strake coupled to and extending from the central vertical stabilizer through the fuselage interior and coupling to the lower fuselage surface at the position of local aft flattening, the flattened fuselage for lateral stiffening of the aircraft structure.
12. The aircraft according to Claim 11 wherein:
the inverted V-tail is integrated into the wing trailing edge, the wing having a gull or dihedral inboard of the couplings of the inverted stabilizers to the wing, the dihedral being sufficient to increase take-off roll at the fuselage tip and to extend lifting length and reduce sonic boom effects.

13. The aircraft according to Claim 11 further comprising:
at least two engine nacelles coupled beneath the wing at the wing trailing edge;
two main landing gear coupled to a lower surface of the wing respectively inboard
of the at least two engine nacelles and capable of retraction into the wing
and fuselage; and
a wing inboard portion configured to integrate with the nacelle and forming a
dihedral gull that enhances low-sonic-boom signature by vertically
staggering longitudinal lift distribution, the dihedral gull being formed by
twisting and cambering the wing for low sonic boom and low induced drag
while preserving a tailored local wing contour at a location of main
landing gear retraction.
14. The aircraft according to Claim 13 further comprising:
a Krueger flap coupled to the leading edge of the wing wherein:
the wing leading edge is sufficiently straight to accommodate a simple hinge line
for the Krueger flap, and the inboard wing integrates with the engine
nacelles and follows the low sonic boom fuselage contour with a
sufficiently normal configuration to attain low interference drag, the wing
having an inboard flap hinge line fully contained within the wing contour
with wing upper and lower surfaces being essentially planar.
15. A supersonic aircraft comprising:
a wing having upper and lower surfaces and extending from a leading edge to a
trailing edge;
at least two engine nacelles coupled to the lower surface of the wing on the
trailing edge;
an inverted V-tail coupled to the wing comprising a central vertical stabilizer, at
least two inverted stabilizers coupled to sides of the central vertical
stabilizer and coupled to the wing and supporting the at least two engine
nacelles; and
at least two wing structural support members coupled to the upper surface of the
wing generally overlying the at least two engine nacelles, the wing

structural support members coupling between the inverted stabilizers and the wing and extending from the wing trailing edge forward, the structural support members adding support to assist carrying engine nacelles weight.

16. The aircraft according to Claim 15 wherein:
the inverted V-tail is integrated into the wing trailing edge, the wing having a gull or dihedral inboard of the engine nacelles, the dihedral being sufficient to increase take-off roll at the fuselage tip and to extend lifting length and reduce sonic boom effects.
17. The aircraft according to Claim 15 further comprising:
two main landing gear coupled to a lower surface of the wing respectively inboard of the at least two engine nacelles and capable of retraction into the wing;
and
a wing inboard portion configured to integrate with the nacelle and forming a dihedral gull that enhances low-sonic-boom signature by vertically staggering wing longitudinal lift distribution, the dihedral gull being formed by twisting and cambering the wing for low sonic boom and low induced drag while preserving a tailored local wing contour at a location of main landing gear retraction.
18. The aircraft according to Claim 17 further comprising:
a Krueger flap coupled to the leading edge of the wing wherein:
the wing leading edge is sufficiently straight to accommodate a simple hinge line for the Krueger flap, and the inboard wing integrates with the engine nacelles and follows the low sonic boom wing contour with a sufficiently normal configuration to attain low interference drag, the wing having an inboard flap hinge line fully contained within the wing contour with wing upper and lower surfaces being essentially planar.

19. The aircraft according to Claim 15 further comprising:
at least one wing rib within the wing and capable of supporting the wing structural support members and reduce and/or eliminate nacelle structural torsion,
the wing structural support members adding volume that integrates with a lowest far-field wave drag penalty and blends, as a fillet, with the inverted V-tail.
20. The aircraft according to Claim 15 further comprising:
a diverter coupling an engine nacelle to a wing, the diverter having a swept leading edge;
a pair of ribs extending through the wing and diverter, the ribs supporting the engine nacelle, the ribs being closely spaced and including a first rib approximately aligned with the center of the nacelle and a second rib outboard of the first rib in a range of locations from the first rib approximately to the outboard edge of the engine nacelle, wherein:
the structural support member extends essentially between the first and second spar and extends vertically upward to the inverted stabilizer to add volume for strength while wrapping about the connection of the wing and inverted stabilizer as an aerodynamic fairing with a minimal drag penalty.